General

Guideline Title

Management of vertebral artery injuries following non-penetrating cervical trauma. In: Guidelines for the management of acute cervical spine and spinal cord injuries.

Bibliographic Source(s)

Guideline Status

This is the current release of the guideline.

Recommendations

Major Recommendations

The rating schemes used for the strength of the evidence (Class I-III) and the levels of recommendations (Level I-III) are defined at the end of the "Major Recommendations" field.

Recommendations

Diagnostic

Level I

- Computed tomographic angiography (CTA) is recommended as a screening tool in selected patients after blunt cervical trauma who meet the modified Denver Screening Criteria for suspected vertebral artery injury (VAI).

Level III

- Conventional catheter angiography is recommended for the diagnosis of VAI in selected patients after blunt cervical trauma, particularly if concurrent endovascular therapy is a potential consideration, and can be undertaken in circumstances in which CTA is not available.
- Magnetic resonance imaging (MRI) is recommended for the diagnosis of VAI after blunt cervical trauma in patients with a complete spinal cord injury or vertebral subluxation injuries.

Treatment

Level III

- It is recommended that the choice of therapy for patients with VAI—anticoagulation therapy vs antiplatelet therapy vs no treatment—be individualized based on the patient's VAI, the associated injuries, and the risk of bleeding.
- The role of endovascular therapy in VAI has yet to be defined; therefore, no recommendation regarding its use in the treatment of VAI can be offered.

Summary

The incidence of vertebral artery injury may be as high as 11% after non-penetrating cervical spinal trauma in patients meeting specific clinical and physical exam criteria. The modified Denver Screening Criteria for blunt cerebrovascular injuries (BCVI) are the most commonly used. Many patients with VAI have complete spinal cord injuries, fractures through the foramen transversarium, cervical spinal facet dislocation injuries, and/or vertebral subluxation, but many patients with these spinal and spinal cord injuries have normal vertebral arteries when imaged, thus reducing the specificity of these injury patterns with respect to VAI. Many comparative studies in which sensitivity, specificity, and positive and negative predictive value have been, or can be, calculated examined various tests against each other, but not against the gold standard of intravenous catheter angiography, thereby producing Class III medical evidence. However, recent literature providing Class I medical evidence does support CTA as a highly accurate alternative to catheter angiography for screening for VAI in blunt injury trauma patients, with a very high negative predictive value.

It appears that a significant number of the symptomatic strokes resulting in neurological deficits following VAI are attributable to the initial blunt traumatic injury. The majority of patients with VAI are asymptomatic, including a number of patients with incidental cerebellar and posterior circulation strokes found on imaging studies at the time of diagnosis or in follow-up. To date, there has been no definitive longitudinal study defining the stroke risk of VAI, asymptomatic or otherwise, among patients being treated for known VAI and/or among patients receiving "no treatment" for known VAI. There is no Class I or Class II medical evidence on the issue of therapy for VAI. Class III medical evidence suggests that a small number of patients with VAI will develop a posterior circulation stroke in delayed fashion beyond deficits associated with the initial traumatic injury. While no conclusive medical evidence supports treatment for VAI, most clinicians support treatment for patients with symptomatic VAI with either anticoagulation or antiplatelet therapy. Because of an increased relative risk of hemorrhagic complications from anticoagulation therapy for VAI, without clear superior efficacy, anticoagulation therapy is not considered ideal treatment in multiple trauma patients with VAI, symptomatic or asymptomatic. Antiplatelet therapy (aspirin the most studied) appears to be a safe and comparable option for symptomatic patients with VAI after blunt trauma.

No treatment or antiplatelet therapy appears to be a comparable option for the treatment of asymptomatic patients with documented VAI. Because antiplatelet therapy has the potential to reduce future stroke risk, treatment with aspirin for documented VAI after trauma should be considered in patients if there exist no contraindications to antiplatelet therapy. At present, the choice of therapy, if any, for patients with VAI should be individualized based on the patient's VAIs, associated traumatic injuries, and the relative risk of bleeding associated with that form of therapy.

Definitions:

Rating Scheme for the Strength of the Evidence: Modified North American Spine Society Schema to Conform to Neurosurgical Criteria as Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question[a]

Class	Therapeutic Studies: Investigating the Results of Treatment	Diagnostic Studies: Investigating a Diagnostic Test	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
I	High-quality randomized controlled trial with statistically significant difference or no statistically significant difference but narrow confidence intervals	Testing of previously developed diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a Ä̧ statistic ≥0.60 or an intraclass correlation coefficient of ≥0.70
	Systematic review[b] of Class I randomized controlled trials (and study results were homogeneous[c])	Systematic review[b] of Class I studies	
II	Lesser-quality randomized controlled	Development of diagnostic	Evidence provided by 1 or more well-designed clinical

Class	Therapeutic Studies: Investigating the Results of Treatment	Diagnostic Studies: Investigating a Diagnostic Test [a]	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
trial (e.g., <80% follow-up, no blinding, or improper randomization)	criteria on consecutive patients (with universally applied reference "gold" standard)	studies in which interobserver and intraobserver reliability is represented by a Ä statistic of 0.40–0.60 or an intraclass correlation coefficient of 0.50–0.70	
	Prospective[d] comparative study[e]	Systematic review[b] of Class II studies	
	Systematic review[b] of Class II studies or Class I studies with inconsistent results	Study of nonconsecutive patients; without consistently applied reference "gold" standard	
	Case-control study[g]	Systematic review[b] of Class III studies	
	Retrospective[f] comparative study[e]	Case-control study	
	Systematic review[b] of Class II studies		
III	Case series[h]	Poor reference standard	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a Ä statistic of <0.40 or an intraclass correlation coefficient of <0.50
	Expert opinion	Expert opinion	

[a]A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.

[b]A combination of results from 2 or more prior studies.

[c]Studies provided consistent results.

[d]Study was started before the first patient enrolled.

[e]Patients treated 1 way (e.g., halo vest orthosis) compared with a group of patients treated in another way (e.g., internal fixation) at the same institution.

[f]The study was started after the first patient was enrolled.

[g]Patients identified for the study on the basis of their outcome, called "cases" (e.g., failed fusion), are compared with those who did not have outcome, called "controls" (e.g., successful fusion).

[h]Patients treated 1 way with no comparison group of patients treated in another way.

Levels of Recommendation

Level I	Generally accepted principles for patient management, which reflect a high degree of clinical certainty (usually this requires Class I evidence which directly addresses the clinical questions or overwhelming Class II evidence when circumstances preclude randomized clinical trials)
Level II	Recommendations for patient management which reflect moderate clinical certainty (usually this requires Class II evidence or a strong consensus of Class III evidence)
Level III	Other strategies for patient management for which the clinical utility is uncertain (inconclusive or conflicting evidence or opinion)

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

- Vertebral artery injuries (VAIs) following blunt cervical trauma, including complete spinal cord injury and vertebral subluxation injury
- Cerebrovascular insufficiency (stroke) associated with VAI

Guideline Category

Diagnosis

Evaluation

Management

Treatment

Clinical Specialty

Neurological Surgery

Neurology

Orthopedic Surgery

Radiology

Intended Users

Advanced Practice Nurses

Hospitals

Nurses

Physician Assistants

Physicians

Guideline Objective(s)

To update the medical evidence on the diagnostic and treatment recommendations for vertebral artery injury (VAI) after blunt cervical trauma

Target Population

Patients with vertebral artery injuries (VAIs) following non-penetrating cervical trauma

Interventions and Practices Considered

Diagnosis/Evaluation

1. Computed tomographic angiography (CTA)
2. Conventional catheter angiography
3. Magnetic resonance imaging (MRI)

Treatment/Management

1. Individualized choice of therapy based on the patient's vertebral artery injuries (VAIs), associated injuries, and bleeding risk
2. Anticoagulation therapy
3. Antiplatelet therapy
4. No treatment
5. Endovascular therapy (considered but no recommendation made)

Major Outcomes Considered

- Sensitivity, specificity, positive and negative predictive value, and accuracy of diagnostic imaging studies for vertebral artery injury (VAI)
- Incidence of VAI following blunt cervical trauma
- Stroke rate
- Complications of anticoagulant and antiplatelet therapy

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Search Criteria

A National Library of Medicine (PubMed) computerized literature search of publications from 1966 to 2011 was performed using the following headings: vertebral artery injury, vertebral artery dissection, cervical fracture, and cervical dislocation. The search was limited to the English language and human subjects and identified 2,226 citations. The titles and abstracts of these references were reviewed to determine relevance. Isolated case reports, small case series, editorials, letters to the editor, and review articles were eliminated. The bibliographies of the resulting full-text articles were searched for other relevant citations.

Number of Source Documents

A total of 37 articles met inclusion criteria and 21 key citations are summarized in Evidentiary Table format (see Tables 4 and 5 in the original guideline document).

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

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Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question[a]

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Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Selected articles were carefully reviewed by the authors. Evidentiary tables were created (refer to Tables 4 and 5 in the original guideline document) that reflected the strengths and weaknesses of each article.

On occasion, the assessed quality of the study design was so contentious and the conclusions so uncertain that the guideline authors assigned a lower medical evidence classification than might have been expected without such a detailed review. In every way, adherence to the Institute of Medicine's criteria for searching, assembling, evaluating, and weighing the available medical evidence and linking it to the strength of the recommendations presented in this document was carried out.

Articles that did not achieve immediate consensus among the author group were discussed extensively until a consensus was reached. Very few contributions required extensive discussion. Most articles were easily designated as containing Class I, II, or III medical evidence using the criteria set forth by the author group at the initiation of the literature evaluation process (see the "Rating Scheme for the Strength of the Evidence" field).

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

The current author group was selected for its expertise in spinal surgery (both neurosurgical and orthopedic), neurotrauma, clinical epidemiology, and, in several cases, prior experience with guideline development. The topics chosen for inclusion in this iteration of these guidelines are contemporary and pertinent to the assessment, evaluation, care, and treatment of patients with acute cervical spine and/or spinal cord injuries.

Rating Scheme for the Strength of the Recommendations

Levels of Recommendation

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Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Not stated

Description of Method of Guideline Validation

Not applicable

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Accurate diagnosis and appropriate management of vertebral artery injury (VAI) and reduced stroke risk following blunt cervical trauma

Potential Harms

- Catheter angiography is an invasive and labor-intensive procedure, is not always readily available, and has a low, but finite risk.
- Because of an increased relative risk of hemorrhagic complications from anticoagulation therapy for vertebral artery injuries (VAI), without clear superior efficacy, anticoagulation therapy is not considered ideal treatment in multiple trauma patients with VAI, symptomatic or asymptomatic.

Contraindications

Contraindications

- Traumatic vertebral artery injury (VAI) occurs in multiple injured trauma patients and is more likely to occur in association with the most severe cervical spine and spinal cord injuries—all of which represent relative contraindications to anticoagulation and antiplatelet therapies in the treatment of potential posterior distribution stroke.
- The need for dual antiplatelet therapy after endovascular procedures and their potential for bleeding complications is a relative contraindication to the application of endovascular therapy in multiple injury trauma patients with VAI.

Qualifying Statements

Qualifying Statements

- Medical evidence-based guidelines are not meant to be restrictive or to limit a clinician's practice. They chronicle multiple successful treatment options (for example) and stratify the more successful and the less successful strategies based on scientific merit. They are not absolute, "must be followed" rules. This process may identify the most valid and reliable imaging strategy for a given injury, for example, but because of regional or institutional resources, or patient co-morbidity, that particular imaging strategy may not be possible for a patient with that injury. Alternative acceptable imaging options may be more practical or applicable in this hypothetical circumstance.
- Guidelines documents are not tools to be used by external agencies to measure or control the care provided by clinicians. They are not medical-legal instruments or a "set of certainties" that must be followed in the assessment or treatment of the individual pathology in the individual patients we treat. While a powerful and comprehensive resource tool, guidelines and the recommendations contained therein do not necessarily represent "the answer" for the medical and surgical dilemmas faced with many patients.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Mobile Device Resources

> For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Staying Healthy

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

> Harrigan MR, Hadley MN, Dhall SS, Walters BC, Aarabi B, Gelb DE, Hurlbert RJ, Rozzelle CJ, Ryken TC, Theodore N. Management of vertebral artery injuries following non-penetrating cervical trauma. In: Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery. 2013 Mar;72(Suppl 2):234-43. [38 references] PubMed

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2013 Mar

Guideline Developer(s)

American Association of Neurological Surgeons - Medical Specialty Society

Congress of Neurological Surgeons - Professional Association

Source(s) of Funding

Guideline Committee

Guidelines Author Group of the Joint Section of Disorders of the Spine and Peripheral Nerves of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons

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Financial Disclosures/Conflicts of Interest

The authors have no personal financial or institutional interest in any of the drugs, materials, or devices described in this guideline.

Guideline Status

This is the current release of the guideline.

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) and EPUB for eBook devices from the Neurosurgery Web site _____.

Availability of Companion Documents

The following are available:

- Foreword. Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):1. Electronic copies: Available in Portable Document Format (PDF) from the Neurosurgery Web site _____.
- Commentary. Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):2-3. Electronic copies: Available in PDF from the Neurosurgery Web site _____.
- Introduction to the guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):5-16. Electronic copies: Available in PDF from the Neurosurgery Web site _____.
- Methodology of the guidelines for management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):17-21. Electronic copies: Available in PDF from the Neurosurgery Web site _____.

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on July 9, 2013. The information was verified by the guideline developer on October 3, 2013.

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